(19) Europäisch s Patentamt
European Patent Offic
Offic européen d s brevets

(11) Publication number: **0 119 135**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 84400447.3

(22) Date of filing: 06.03.84

(51) Int. Cl.³: F 01 M 13/02

(30) Priority: 08.03.83 JP 32217/83 U

(43) Date of publication of application:
19.09.84 Bulletin 84/38

(84) Designated Contracting States:
DE FR GB IT

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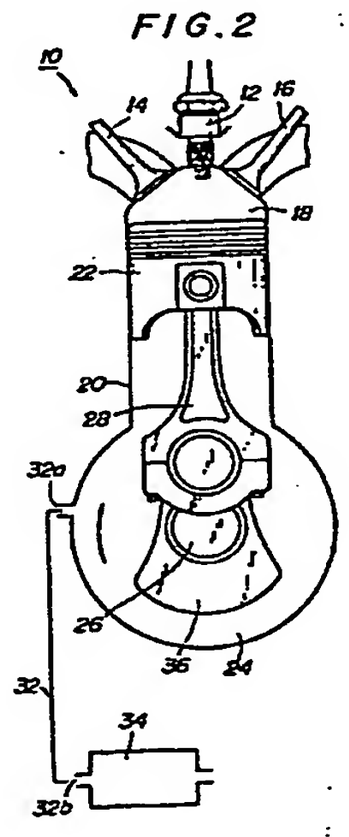
(54) Internal combustion engine having negative pressure space portion.

(57) A space portion is provided at least around an output shaft of an internal combustion engine 10 and negative pressure generating means 34 is communicated with this space portion 24. This negative pressure generating means is made operative to drain the air in the space portion, thereby setting a pressure in the space portion into a desired negative pressure.

FIG.2



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TITLE OF THE INVENTION

INTERNAL COMBUSTION ENGINE HAVING NEGATIVE PRESSURE SPACE PORTION

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an internal combustion engine having a negative pressure space portion and, more particularly, to an internal combustion engine having a negative pressure space portion whereby the negative pressure space portion is formed around an output shaft of an internal combustion engine.

Description of the Prior Art

A pressure in a crankcase formed in the lower portion of an internal combustion engine, e.g., a reciprocating engine is set to be substantially euqal to an atmospheric pressure. Upon operation of the engine, a piston reciprocates in a cylinder, thereby performing the respective steps of suction, compression, explosion, and exhaust. At the same time, the piston is subjected to the explosion pressure and transfers the power through a connecting rod to a crankshaft as an output shaft, thereby obtaining a power due to the rotational motion of this crankshaft.

However, upon operation of the engine, the reciprocating motion of the piston, particularly the motions at the time of the suction and explosion actions and the rotational motion of the connecting rod and the crankshaft are disturbed by the air in the crankcase, so that the output of the engine is reduced.

In addition, the above-mentioned air in the crankcase causes the deterioration in quality such as the oxidation of an engine oil or the like; therefore, in a lubricating device using this engine oil, there is such an inconvenience that it is impossible to satisfactorily perform the important actions such as the lubricating action of various kinds of parts, cleaning action, etc.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an internal combustion engine having a negative pressure space portion whereby: an air resistance in the engine is reduced in operation of the internal combustion engine; an engine output efficiency and a ratio of a fuel consumption quantity to a unit run distance of a motor vehicle are improved; deterioration in quality such as the oxidation of an engine oil or the like due to oxygen in the air is prevented; a service life of the engine oil is elongated; and the expenses are cut down.

The above object is accomplished by an internal combustion engine which is constituted as follows. Namely, a space portion is provided around at least an output shaft of the internal combustion engine and negative pressure generating means is communicated with this space portion. The negative pressure generating means comprises, for example, a vacuum pump and by making this vacuum pump operative, the air in the space portion is drained to the outside, thereby enabling the pressure in the space portion to be in a desired negative pressure.

According to the present invention, the following effects are obtained.

(a) An air resistance can be reduced in operation of an internal combustion engine and an engine output efficiency can be raised, while a ratio of the fuel consumption to the run distance can be improved.

(b) A deterioration in quality such as oxidation of an engine oil due to the air, or the like can be prevented, thereby enabling the service life of the engine oil to be elongated and enabling the expenses to be saved.

(c) The above-mentioned effects can be improved more and more as a degree of vacuum in the space portion is raised, i.e., as the negative pressure therein is increased.

(d) The present invention can be also applied to a blowby gas which flows from the combustion chamber of the internal combustion engine into the space portion.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1 - 3 illustrate a first embodiment of the present invention, in which

Fig. 1 is a cross sectional view with a part cut away of the main part of an engine;

Fig. 2 is a schematic enlarged diagram at a top dead point of a piston of the engine;

Fig. 3 is a schematic enlarged diagram at a bottom dead point of the piston of the engine; and

Fig. 4 is a schematic enlarged diagram of the engine

showing a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the present invention will be described in detail hereinbelow with reference to the drawings.

Figs. 1 - 3 illustrate a first embodiment of the present invention. In Figs. 1 - 3, a reference numeral 10 denotes a gasoline engine as an internal combustion engine; 12 indicates a spark plug; 14 is an intake valve; 16 an exhaust valve; 18 a combustion chamber; 20 a cylinder; 22 a piston adapted to be slidably moved in the cylinder 20; 24 a crankcase as a space portion provided around an output shaft; 26 a crankshaft as an output shaft; 28 a connecting rod for coupling the piston 22 with the crankshaft 26; and 30 an oil pan.

One end 32a of a negative pressure passageway 32 opens in and is communicated with the crankcase 24 in the lower portion of the gasoline engine 10, while the other end 32b of the negative pressure passageway 32 opens in and is communicated with a vacuum pump 34 as negative pressure generating means. In this embodiment, the vacuum pump 34 is not made operative by the piston motion of the gasoline engine 10 or by the rotational motion of the crankshaft, but it is operated by the driving force to be generated by another driving apparatus, e.g., an electric motor.

A reference numeral 36 represents a balance weight of the crankshaft 26.

The operation of the first embodiment will then be described.

The vacuum pump 34 is made operative to drain the air in the crankcase 24 through the negative pressure passageway 32. Due to this a pressure in the crankcase 24 becomes a desired negative pressure.

In operation of the engine, as shown in Figs. 2 and 3, the piston 22 vertically reciprocates from the top dead point to the bottom dead point. The crankshaft 26 is rotated through the connecting rod 28 due to this vertical reciprocating motion. At this time since the crankcase 24 is in the negative pressure state, this enables an air resistance to be reduced in the vertical motion of the piston 22, particularly, in the descending motion thereof and the rotational motion of the crankshaft 26. Thus, the vertical motion of the piston 22 and the rotational motion of the crankshaft 26 can be smoothly performed. In addition, it is also possible to prevent deterioration in quality of an engine oil due to the air in the crankcase 24.

On the other hand, although a pressure in the crankcase 24 has been set into a desired negative pressure, the above-mentioned operational effect can be further improved as a degree of vacuum, i.e., a negative pressure is increased.

Fig. 4 illustrates a second embodiment of the present invention. In this second embodiment, the parts and components having the same functions as those of the parts and components shown in the first embodiment are designated by the same reference numerals. A feature of the second embodiment is that the crankshaft 26 and the vacuum pump 34 as the negative pressure generating means are interlocked by momentum transfer means 40.

In other words, when the crankshaft 26 is rotated upon operation of the engine, this rotational force is transferred to the vacuum pump 34 through the momentum transfer means 40, thereby making the vacuum pump 34 operative. The air in the crankcase 24 is drained through the negative pressure passageway 32 by the vacuum pump 34, thereby causing a pressure in the crankcase to be negative.

Namely, since the vacuum pump 34 can be operated upon operating the engine, a pressure in the crankcase 24 can be always maintained into an optimum nagetive pressure and it is also possible to cope with a downstream of a blowby gas, thereby enabling the vertical motion of the piston and the rotational motion of the crankshaft to be smoothly performed.

In addition, the present invention is not limited to the above embodiments, but many variations and modifications are possible.

For example, although the above first and second embodiments have been described with regard to a gasoline engine, the present invention can be also employed to other various kinds of engines (e.g., a diesel engine, etc.) in the internal combustion engine. In addition, in a rotary engine of the internal combustion engine, by setting a pressure in a space which is constituted by an internal gear of a rotor and a stationary gear into a negative pressure, an air resistance in the engagement of each gear upon rotation of the rotor is decreased and the rotor and an eccentric shaft are rotated smoothly, thereby enabling an output efficiency of the engine

to be improved.

In addition, in the second embodiment, the blowby gas which flows from the combustion chamber into the crankcase is always drained from the crankcase by the vacuum pump which is interlocked with the crankshaft and a pressure in the crankcase is set into a negative pressure; however, it is also possible to maintain the pressure in the crankcase to be negative by other methods such as a method of utilizing the reciprocating motion of the piston and the negative pressure of a suction tube, or the like.

Furthermore, in the first and second embodiments, the engine and the vacuum pump as the negative pressure generating means were communicated by the negative pressure passageway and are integrally constituted, but it may be possible to constitute in such a manner that the engine and the negative pressure passageway or the vacuum pump are detachably provided and the pressure in the crankcase is set into a negative pressure using the vacuum pump if necessary. With such a constitution, it is possible to reduce the number of steps of attaching the vacuum pump and the negative pressure passageway without causing any inconvenience of an increase in weight of a vehicle.

WHAT IS CLAIMS IS:

1. An internal combustion engine having a space portion provided at least around an output shaft of the internal combustion engine, a pressure in said space portion being set into a negative pressure.

2. An internal combustion engine having the negative pressure space portion according to claim 1, wherein said internal combustion engine is a reciprocating engine.

3. An internal combustion engine having the negative pressure space portion according to claim 2, wherein said space portion is a crankcase provided around a crankshaft as the output shaft.

4. An internal combustion engine having the negative pressure space portion according to any one of claims 1, 2 and 3, wherein negative pressure generating means for setting the pressure in the space portion into a negative pressure is a vacuum pump.

5. An internal combustion engine having the negative pressure space portion according to claim 4, wherein said vacuum pump is made operative by an electric motor.

6. An internal combustion engine having the negative pressure space portion according to claim 4, wherein said vacuum pump is made operative by the rotational motion of a crankshaft of said internal combustion engine through momentum transfer means.

7. An internal combustion engine having the negative pressure space portion according to claim 1, wherein said

internal combustion engine is a rotary engine.

8. An internal combustion engine having the negative pressure space portion according to claim 7, wherein said space portion is formed by an internal gear and a stationary gear.

FIG.1

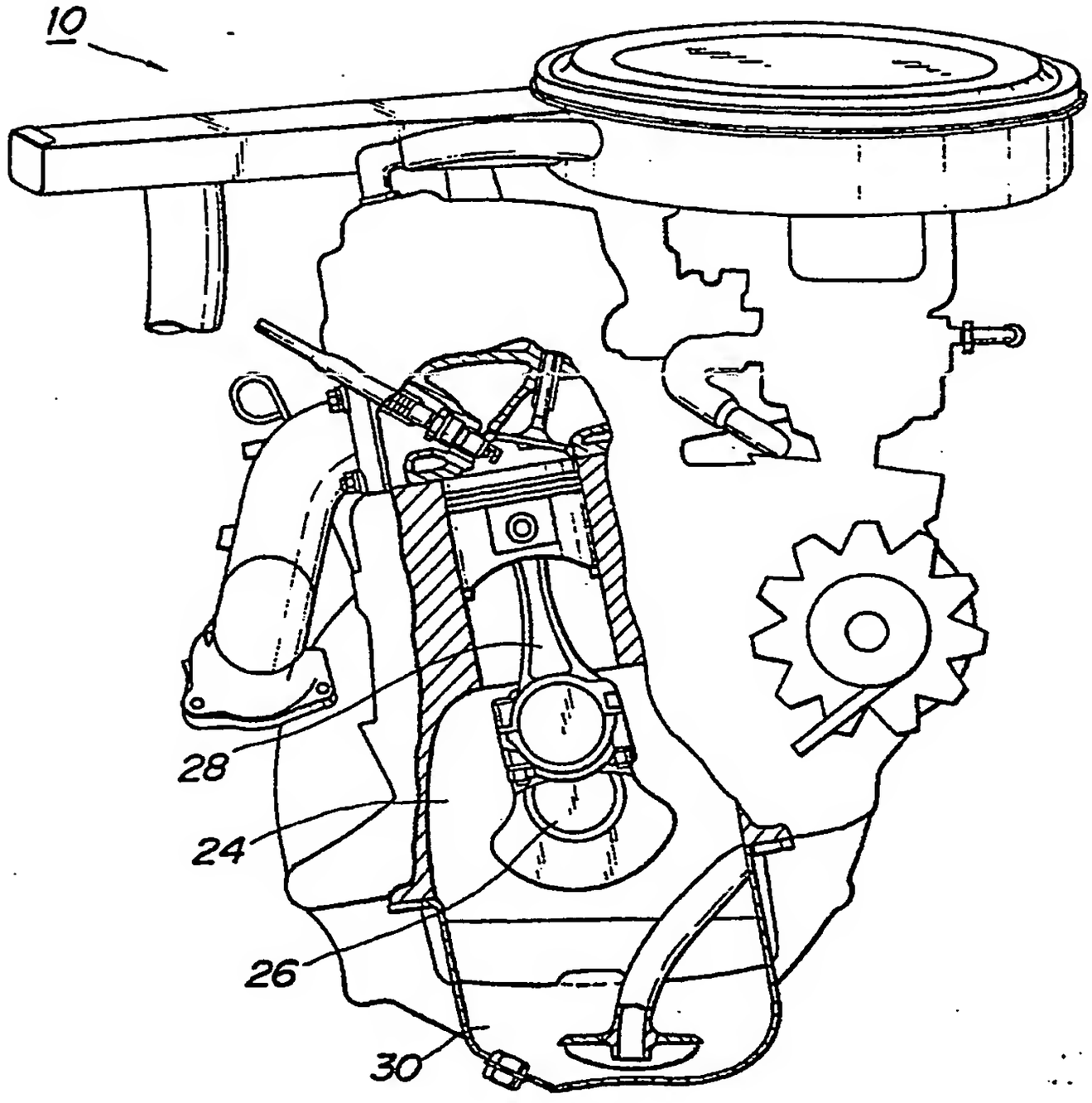

FIG.2

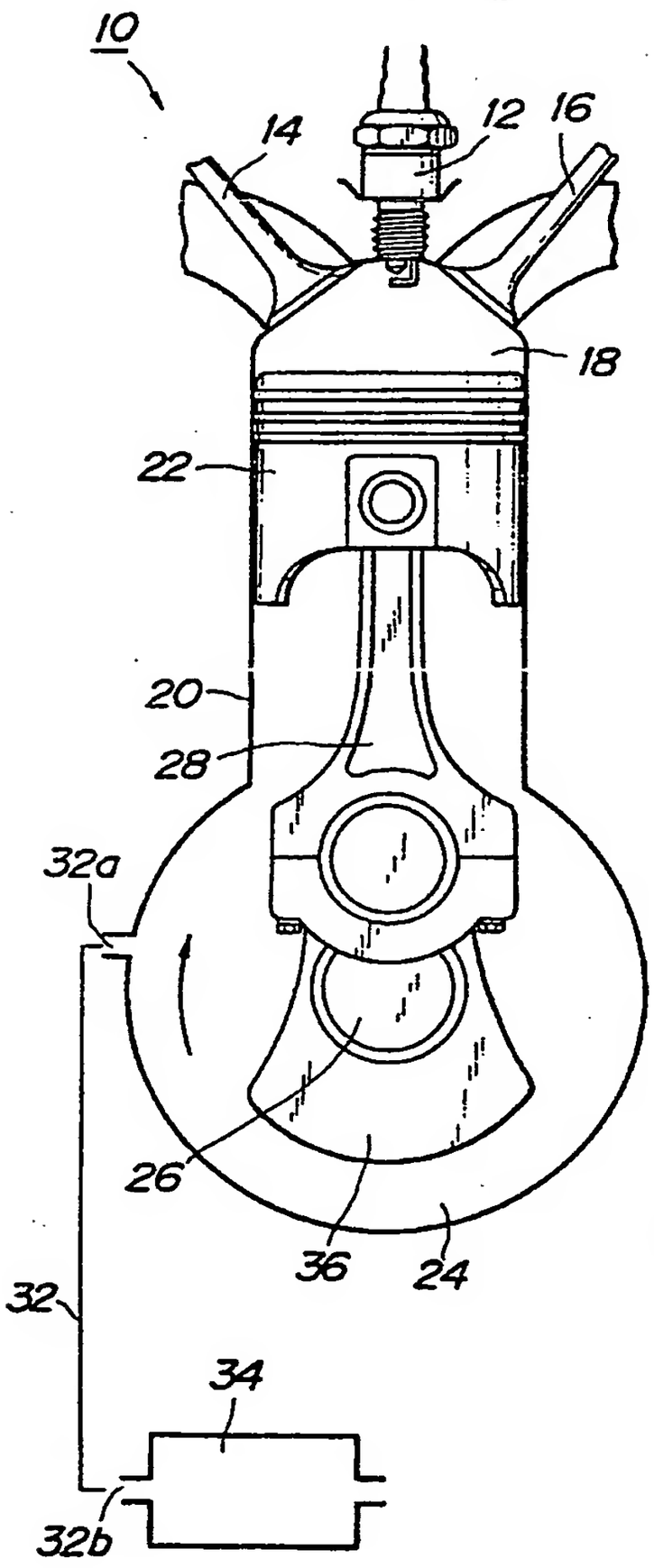
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FIG.3

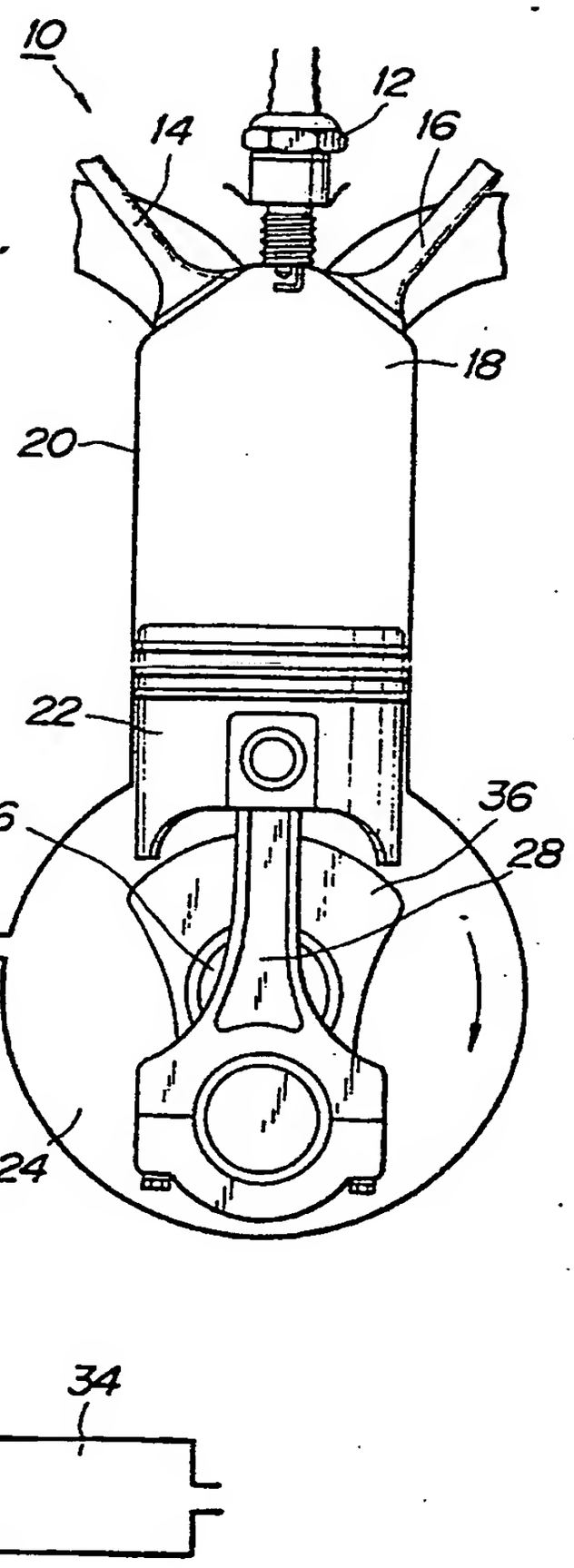
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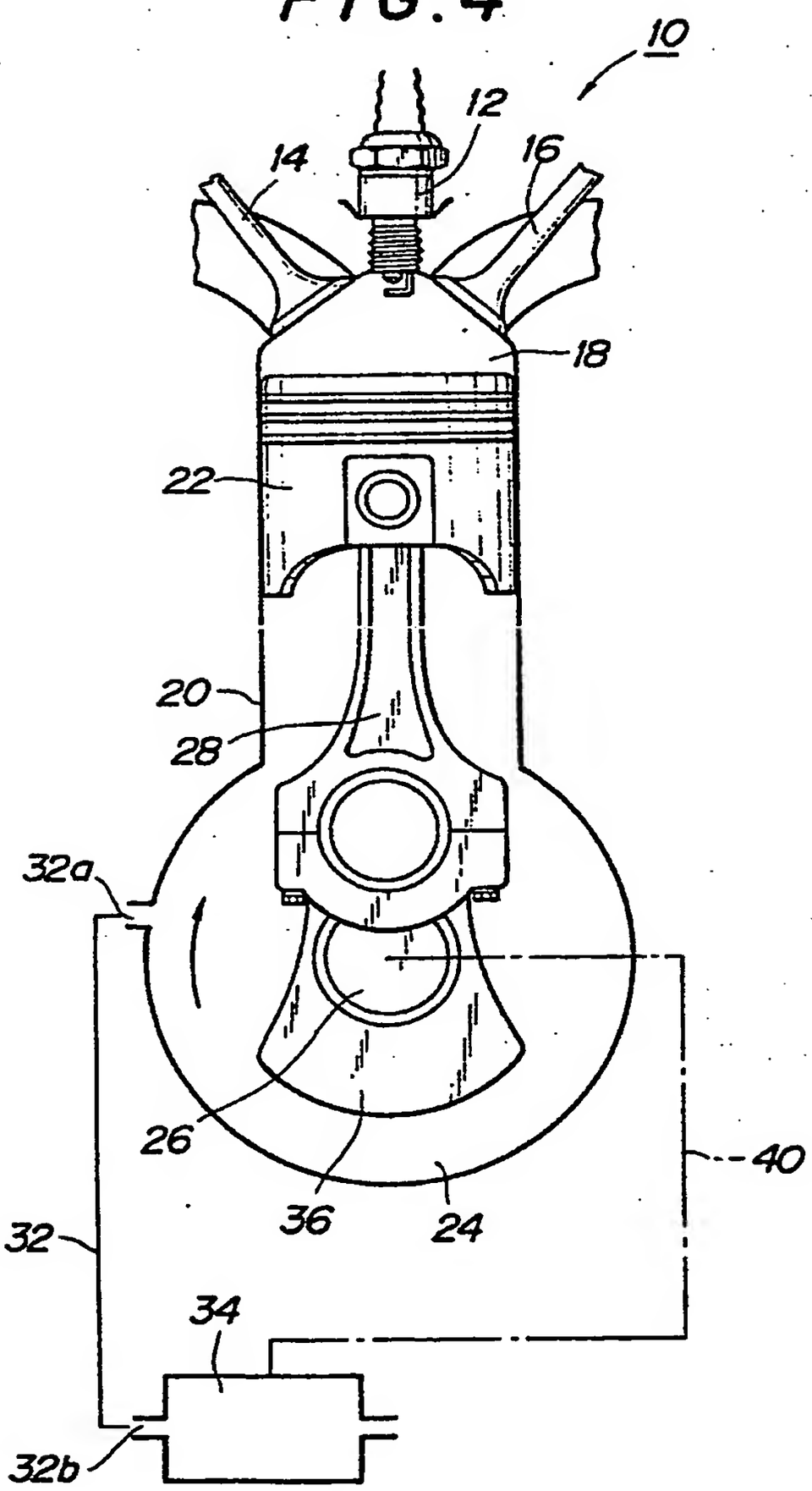
FIG.4



European Patent Office

EUROPEAN SEARCH REPORT

0119135
Application number

EP 84 40 0447

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	US-A-4 257 383 (BOSWELL) * Column 1, lines 27-58; figures 1,2 *	1-4,6	F 01 M 13/02
Y		5	

Y	US-A-2 271 150 (DRESSLER) * page 1, left-hand column, lines 32-41; right-hand column, lines 34-46; figures 1,4 *	5	

A	FR-A-2 501 783 (LEFEUVRE) * Page 5, lines 26-36; figures 1,3 *	7,8	

A	GB-A-2 006 329 (SEMT)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	07-06-1984	KOOIJMAN F.G.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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D : document cited in the application
L : document cited for other reasons

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